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ABSTRACT

Obesity is one of the leading public health problems in the United States. It is associated with drug abuse and increased mortality. In seeking to differentiate between overweight and obese individuals, it may be said that obesity exists in those individuals who are 40% or more above normal weight as determined on commonly used height and weight tables. However, overweight subjects are those whose height-weight relationship is 10-39% above normal. In the normal body there is an essential amount of fat, between 2% and 6%. It is felt that men should not exceed 15-20% and women 25-30% body fat as calculated by the body density, which is determined from the ratio of the individual's body weight to body volume. It is reported that 49% of the adult population in the United States is overweight or obese. An estimated 2/3 of these individuals seek a means of weight reduction resulting in the aggregate cost of 10 billion dollars a year spent on "dieting." A study of two groups of high school girls showed inactivity as a much more important factor than overeating in the development and maintenance of obesity. Genetic factors, overfeeding of babies, and neurotic behavior problems all contribute to obesity. The lives of most obese subjects are vicious cycles of weight gain and loss. There is a wide variety of programs to gain the attention of the obese, including reduction programs by dieting, drugs, hypnosis, psychotherapy, and surgical intervention. These have met with varied success. (MM)

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THE MEDICAL ASPECTS OF OBESITY

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Obesity is one of the leading public health problems in the United States. The lowest common denominator that can attest to this being a problem of the highest priority is the increased mortality that has been shown to be related to obesity. In addition, the accompanying clinical abnormalities of great frequency are: elevated blood pressure, carbohydrate intolerance, lipid abnormalities, hyperuricemia, gout, cardiovascular disease, gallbladder disease and they are directly related to obesity. Since both morbidity and mortality are enhanced by obesity the problems of effective treatment must be sought. The criteria of success for a weight reduction program is not only the immediate loss of weight by the obese patient but the maintenance of optimal weight throughout the remainder of the life of the individual. Massive obesity is a correctable malady and treatment is worthwhile since many of the problems of obesity are totally alleviated with weight reduction. To assert that all types of obesity are primarily caused by overeating is an oversimplification. At least in some types of obesity a determining factor is the degree of efficiency with which the weight regulating mechanism operates. It is my feeling, shared by many, that obesity is a disturbance of the whole person, best viewed as having multiple causes: metabolic, neurological, psychological and socio-economic.

Generally we agree that obesity may be defined in terms of an excess of adipose tissue. This can be estimated from measurement of body size and weight; an indirect estimate of the proportion of adipose tissue on the body may be derived from the measurement of the

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triceps skinfold thickness. The traditional approach of using standardized weight tables adjusted for sex, height, age and frame size has been shown to be grossly inaccurate for a large percentage of the population (1). In seeking to differentiate between overweight and obese individuals we may state that obesity exists in those individuals who are forty percent or more above normal weight, as determined on commonly used height weight tables. Overweight subjects are those whose height-for-weight relationship is ten to thirty-nine percent above normal. Other groupings or definitions come from ethnic, religious, or parental definitions. In various categories there are height-for-weight variations of more than just pounds, for example, in the case of a six foot male with a large frame who does not bear excessive fat but far abundant muscle mass. Thus, an individual may not fall within the normal range of height-for-weight and in actuality does not have an excess of body fat.

One may assume that in the normal body there is an essential amount of fat, probably between two and six percent of the total body weight. It is felt that men and women should not exceed 15 - 20% and 25 - 30% body fat, respectively, as calculated by the body density.

Body density is determined from the ratio of the individual's body weight to body volume. Utilizing Archimedes' principle, one can calculate body volume from the actual weight of the individual, his weight while completely submerged in water, and the weight-density of water. When such a measurement is made, one must correct for the individual's residual volume or the air left in the lungs at the time

the underwater weight is recorded. This trapped air gives buoyancy, resulting in an overestimation of body volume and body fat.

Another measurement of the body density, lean body weight, or percentage of body fat, can be estimated from prediction-equations based on specific skinfold or girth measurements obtained by using a pinch of skin. A commonly used area is the triceps, slipped between the jaws of the caliper. One then measures the two layers of skin and the interposed layer of fat. Skin fold thicknesses from several sites are used in the equation to estimate the amount of lean body weight and total body fat. (This has been discussed and demonstrated by Doctor Kaufman.)

We appreciate that body-weight responds automatically and passively to an increase or a decrease in food consumed as well as changes in physical activity.

Obesity is probably the most important nutritional disease in the United States. It is reported that 49% of the adult population in the United States is obese or overweight (2). It is estimated that two-thirds of these individuals seek a means of weight reduction resulting in the aggregate cost of ten billion dollars a year spent on "dieting" fads, fancies and foods (3). Only five percent, approximately, of the obesity in man is classified on a basis that is not in the category of exogenous obesity (4). These may include: pathology of the Hypothalmus in the form of tumors, inflammation, trauma, or from intracranial pressure; genetic causes of obesity, related to syndromes such as the Laurence-Moon-Bardet-Biedl, Prader-Willi, Aistrom's and others; and

endocrine causes in such diseases as Cushing's syndrome, Insuiionoma, the Stein-Leventhal syndrome and in pregnancy, and castration. Less common are factors not related to exogenous obesity such as drugs, including Cortisone, excess insulin, Phenothiazines and others. Not to be forgotten is inactivity.

Approximately ninety-five percent remains in the loosely defined category of "exogenous obesity". This may fall under the law of conservation of energy: "If fat is to be removed from the body, fewer calories must be put in than are taken out and/or more calories must be taken out than are put in"according to Richardson (5). He further stated that obesity was a manifestation of neurosis. This is a manifestation of anxiety, guilt or depression with food diminishing these tensions or acting as a substitute gratification, which in extreme cases is almost an addiction. Such overeating is for non-nutritional purposes and in actuality these obese individuals are unaware of sensations of hunger.

Inactivity as a cause of obesity, said to be a factor in less than five percent of the cases, merits discussion. It is fallacious, first, to assume that exercise consumes relatively little energy and second, to assume that the appetite is enlarged automatically when exercise is increased (6). Two related facts have been demonstrated in experimental animals and in adult men; one, short periods of activity are followed by increases in daily intake and two, the total absence of such activity leads to accumulation of weight, even in already obese men. In several studies with children, correlation bet-

ween fat and inactivity has been clearly demonstrated. Admittedly assessment of caloric intake of an individual is notoriously difficult and becomes even more so when dealing with obese subjects. Activity data are at best semiquantitative (and are only a relative assessment). Johnson (6) asserted that on a statistical basis inactivity was much more important than eating in the development and maintenance of obesity in two groups of high school girls.

It is generally accepted that infantile obesity, particularly that which develops in the first year of life results usually from an increase in the number of fat cells. In addition, the size of the fat cell may be markedly increased. Samples of depot fat from the adipose tissue of a baby's buttock tend to have larger fat cells than those from the abdominal wall. This requires caution in assuming that buttocks fat samples are representative of all depot fat. Also, with artificial feeding there results a diversity of the fat component of the cell relating to the diversity of some milks which vary in content of linoleic acid and fatty acids. It must be admitted that the consequences, short or long-term, from the type of lipid that is laid down by the baby in the first months of life are not known. Some argue that a high linoleic acid content is unphysiological. During the first six months of life, cell multiplication cannot be great since the increase in body fat is largely accounted for by the conspicuous increase in cell size. Over-feeding a baby certainly leads to abnormally large weight gain. Size of fat cells in adipose tissue

can be measured directly by viewing under the microscope samples obtained by surgery, needle biopsy and at post mortem (8). At twenty-eight weeks gestation the mean diameter of fat cells is 40 um, at term 65 um, and at six months of age 110 um. The ratio at these three ages is estimated 1:4:20. Since the fetus increases in total body fat between 28 and 40 weeks from 40 g to 420 g which is ten fold and the volume of the average fat cell increases only 4 fold, then fat cell multiplication must have taken place. We can be certain that overfeeding leads to abnormal gain in total body fat and that probably there is undue fat cell multiplication.

There developed a trend in the 1930's which strengthened in the 40's, to provide solid foods for infants in the first months of life. It was subsequently found that these diets were associated with obesity, that 40 percent of the obese children were not breast fed and, that the solid diets were much higher in caloric content than the recommended allowance (9). We are left in the dilemma of not being certain how to best meet the feeding requirements of the newborn and infant.

The genetic component is the single greatest risk factor in the development of obesity. The incidence of childhood obesity is approximately 40 percent if one parent is fat. If both parents are obese this incidence rises to 80 percent. The result of overfeeding in infancy is that the number of fat cells are increased and this appears to be the critical element. A fat cell that is over-sized can be reduced. It greatly behooves the physician advising on the feeding of infants to provide diet conseling even before a baby is born. This

may preclude the overfeeding especially since modern advertising promotes the concept that excessive feeding is better than underfeeding!

The term "body image" refers to the concept which each individual has of his own body as an object in space, independently and apart from all other objects. The individual with neurotic behaviour problems may not only have a distorted view of his body but may also have the problem of overeating. The disturbed individual may be overwhelmingly preoccupied with obesity to the exclusion of other personal problems regardless of his intelligence, wealth or talents. There may be contempt for those who are thin and a loathsome attitude toward his own body which is viewed as grotesque and with sorrow and contempt. In contra-distinction the body image distortions are not present in the emotionally healthy obese person. Also, a distorted view of body image is not always present in the obese and emotionally disturbed individual. Many of the obese and disturbed individuals avoid seeing themselves to lessen their contempt for their appearance. In the fat individual without the disturbed body image there is heard the expression of surprise on seeing themselves in a mirror with the idea of having just become so fat. For the fat individual with emotional disturbance there may be a relation of his body distortion to those of the opposite sex. He manifests concern for selection of a partner, and finds incompatibilities that are related to size. By contrast, an obese man with no body image problem may speak of himself as a most desirable partner.

There are three factors which predispose an obese individual to

the development of a disturbed body image: (1) Age of onset of obesity (2) Existence of a neurosis, and (3) parental evaluation of the obesity (10).

The development of obesity during childhood is associated with the disorder of concept in body image. The sustained state of obesity is equal for those who became fat in childhood and/or in adulthood. In those with onset of fat in childhood, the presence of a disturbed family environment predisposes them to a disturbance in body image. A secure childhood and a stable personality seem to prevent such disturbances in personality. This disturbance in body image is only one of the manifestations of emotional disturbance.

A detrimental parental evaluation of a child's obesity is the third factor which we have found to cause the distorted body image. If the family values large size for the child and appreciates obesity as manifesting good health and strength, then obesity reinforces self esteem and a good body image despite other emotional disturbances. Also, consideration for body image has wide swings; fluctuations are extreme and extend for periods of time that are both short and long. If things are going well and a patient with a disturbed body image is in good spirits then there may be no problems regarding the obesity and body image.

We see that a disturbed body image has critical factors that are associated not only with age of onset, parental influences, and a generally disturbed emotional make-up but also with environmental factors at the specific time of development of obesity. Intensive psychotherapy can modify these disturbances and help a small number of

people but a more fruitful approach would be the preventive one with modification of body weight during childhood.

In teen-agers dieting for weight control (11), self-perception was a factor in motivation (to reduce body weight). Criteria for such action was varied and the percentage of dieting children among these whom we can consider as obese varied and with the majority it was 120% of the criteria for obesity. A definite sex relationship recognition of obesity and appropriate action being taken is three times greater among girls than boys. The wide variety of causes for obesity has an effect on the action which dieters may take. Many show preference for caloric reduction without consideration of exercise and vice-versa. In the effort to reduce many may not conform to good nutritional practices.

Agreement is general that obesity may be defined as an excess of adipose tissue but there is no general agreement on the method for the measurement of total body fat. The development of the triceps skinfold thickness measurement resulted in good standard for a common anthropometric measurement for the prediction of body density. Other body sites may be selected for this measurement but the triceps skinfold is a simple, suitable site for field surveys. Such a measure lends itself to the identification of the obese and directs attention towards individuals seeking assistance for correction of body build. This measurement will be demonstrated by the team which has been assembled by Doctor Kaufman.

It is generally agreed that results in the treatment of obesity are markedly consistent for all methods for restructuring the obese

are remarkably poor! We all appreciate that semi-starvation reduces fat stores. Weight loss does not occur in a short time and with little discomfort. It is appreciated that obesity can result from CNS injuries to the hypothalmus, endocrine manipulations, forced feedings and there are even some genetic inheritances demonstrated in rodents. The human volunteer in studies to increase body weight shows decreased release of growth hormone and increased secretion of corticosteroids. In obese patients a low carbohydrate intake decreases and a high CHO intake will increase serum immuneroeative insulin regardless of the state of caloric balance. In the obese individual there may be islet cell hypertrophy and hyper-insulinemia with insulin antagonists to protect against the hyperinsulinemia. Weight gain is associated with increased plasma insulin and a decrease in glucose tolerance. The control of food intake seems to originate in the hypothalmus where the ventromedial nucleus regulates satiety. Destruction of region of the CNS results in an augmentation of the development of obesity. The action of neurotransmitters has a control on obesity (12). For example, small amounts of norepinephrine injected into the ventromedical nucleus of a satiated rat will stimulate food intake. Conversely, alpha blockade in the same area will decrease food intake in a starved rat. A beta-blocker such as Propranolol will increase food consumption. The amphetamines will act as beta stimulators and so may inhibit food intake when injected into the area of the ventromedial nucleus.

In the effort to effect a means of weight loss there is no single

path to success. Obesity is a complex disorder. The lives of most of the obese subjects are vicious cycles of weight gain and loss. There is a wide variety of programs to gain the attention of the obese, including reduction programs by dieting, drugs, hypnosis, psychotherapy and even surgical intervention. In seeking to provide the magic formula the physician lectures the patient and instills feeling of guilt by referring to cheating and weak intellect; this is, for the most part, counterproductive. It is probably better to emphasize improvement in body image and other social and health benefits. We must not fail to emphasize the need for psychologic rapport between patient and physician. Whether the method is total fasting or semi-starvation, the psysiological aspect is similar and weight loss if initially rapid. At the outset, there is large fluid loss with constriction of both plasma volume and extracellular fluid. Patients are often made happy in the self-help weight control programs such as TOPS, Weight Watchers, and the like. The high-protein and low carbohydrate diet popularized by Atkins is unpalatable, satiating and nutritious. Why people overeat and how to overcome this biologically inappropriate form of eating and living is the question. This includes the problem of underexercise in the problem of obesity.

It is widely accepted that eating disorders are learned behaviors which have become reflexive. To reeducate the patient with behavior modification requires the setting up of small, specific and achievable goals with some positive reinforcement. Some cues for this behavior

modification come from the environment and such factors must be identified and restructured for that individual. Obesity is serious. Drug abuse is frequently encountered with those who are desperate to gain the weight loss goal. Hormonal drugs such as Thyroid, Human Chorionic gonadotropin and even growth hormones have indivations for use in treatment though limited from many aspects. The surgical approach with bypass in the form of a jejuno-ileal shunt to result in mal-absorption is a method to be carefully evaluated before being utilized. After small bowel bypass surgery, the reestablishment of a normal bowel continuity may be required to reverse polyarthritis and fatty degeneration of the liver.

It can be stated without fear of contradiction, "obesity is detriment to longevity". Obvious measures for treating obesity have met with varied success. Adipose cells grow smaller with weight loss, but the total number of fat cells is unchanged. There are no specific recommendations for correction of obesity that I can offer!

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